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**BOEING REALTY CORPORATION  
FORMER C-6 FACILITY  
LOS ANGELES, CALIFORNIA**

**TECHNICAL MEMORANDUM ADDENDUM NO. 1**

**GROUNDWATER SCREENING CONCENTRATIONS**

**To:** Mr. Brian Mossman  
Boeing Realty Corporation  
3855 Lakewood Blvd.  
Building 1A MC D001-0097  
Long Beach, CA 90846

**From:** Haley & Aldrich, Inc.

**Date:** April 13, 2001

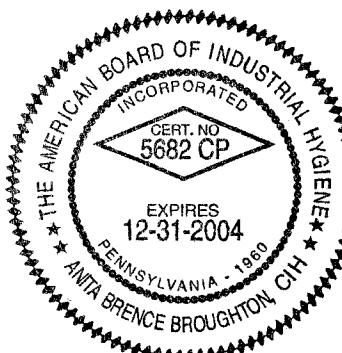
**Re:** Revised Table 1 of March 2, 2001 Groundwater Screening Concentrations Technical Memorandum, Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California

Haley & Aldrich, Inc. is providing this Technical Memorandum Addendum No. 1 to the Groundwater Screening Concentrations Technical Memorandum dated March 2, 2001. This addendum includes a revised Table 1 to the above-referenced March 2, 2001 Technical Memorandum.

Should there be any questions, please do not hesitate to contact the undersigned.

Sincerely yours,  
**HALEY & ALDRICH, INC.**

Anita Broughton, CIH  
Risk Assessment Task Manager  
Industrial Environmental Group



Scott P. Zachary  
Project Manager  
Industrial Environmental Group

Attachment:

Revised Table 1

**BOEING REALTY CORPORATION  
FORMER C-6 FACILITY  
LOS ANGELES, CALIFORNIA**

**TECHNICAL MEMORANDUM**

**GROUNDWATER SCREENING CONCENTRATIONS**

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**To:** Mr. Brian Mossman  
Boeing Realty Corporation  
3760 Kilroy Airport Way, Suite 500  
Long Beach, CA 90806

**From:** Haley & Aldrich, Inc.

**Date:** March 2, 2001

**Re:** Groundwater Screening Concentrations for the Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California

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Haley & Aldrich, Inc. is herein providing this technical memorandum to describe the derivation of groundwater screening concentrations for use at the Boeing Realty Corporation's (BRC's) Former C-6 Facility in Los Angeles, California (subject property).

**OVERVIEW/PURPOSE**

The subject groundwater screening concentrations will be used as a tool by the groundwater team to assist with the assessment of groundwater plume delineation. The groundwater screening concentrations were derived for volatile organic compounds (VOCs) using conservative health-based assumptions for the vapor phase migration pathway.

Should groundwater VOC concentrations be less than the groundwater screening values, it is likely that no further action would be required by the regulatory agencies for groundwater concentrations to be protective of human health from the potential vapor migration exposure pathway. If chemical concentrations at the limits of the groundwater plume are greater than the groundwater screening concentrations, it is recommended that additional "step-out" groundwater samples be obtained. Potential human health risk will be quantified later during the performance of the site-specific risk assessments in accordance with the November 29, 2000 document entitled *Risk Assessment Work Plan, Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California* (Work Plan).

**SUMMARY OF DERIVATION METHODOLOGY**

Commercial/light industrial and residential groundwater screening concentrations were calculated for reasonable maximum exposure (RME) scenarios assuming upward VOC vapor migration and inhalation of indoor air. These groundwater screening concentrations were derived using the methodology described in the November 29, 2000 Work Plan, as detailed below.

The San Diego Department of Environmental Health (DEH) Site Assessment and Mitigation (SAM) vapor migration model was used to estimate indoor air concentrations. The Los Angeles Regional Water Quality Control Board (RWQCB) and the California Environmental Protection Agency (Cal-EPA) Office of

Environmental Health Hazard Assessment (OEHHA) verbally approved the use of this model for the subject property. Chemical parameters were obtained from online information sources including:

- the U.S. Environmental Protection Agency Region 9 preliminary remediation goal data sheets,
- the U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), and
- Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base.

Geotechnical input parameters including dry bulk density, total and air-filled porosity, and total organic carbon (TOC) were obtained from analysis of representative soil samples obtained on the subject property.

Exposure parameters for the RME scenarios were obtained from Section 7 of the November 29, 2000 Work Plan. Residential exposure parameters were weighted for a child (6 years, ages 1 through 6) and an adult (24 years) over a 30-year exposure period. It was assumed that impacts are present only in the shallowest encountered groundwater and extend beneath the entire footprint of a single-story structure. Model default parameters were used for concrete foundation attenuation factor (0.01), and the building air exchange rate (0.5 exchanges per hour for a residence, and 0.83 exchanges per hour for a commercial or industrial building).

Toxicity values were updated from the following online sources in order of priority:

1. Cal-EPA OEHHA, Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

The various input parameters and model results are presented in Appendix A for the residential scenario and in Appendix B for the commercial/light industrial scenario.

## GROUNDWATER SCREENING CONCENTRATIONS

The groundwater screening concentrations are presented in Table 1. These values are based on the lowest estimated groundwater concentration associated with either an excess lifetime cancer risk of one in a million ( $1 \times 10^{-6}$ ) or a hazard index of 0.33 for potential noncancer adverse health effects. Since the acceptable risk thresholds identified in the November 29, 2000 Work Plan are an excess lifetime cancer risk of  $1 \times 10^{-5}$  and a hazard index of 1.0, the groundwater screening concentrations have been developed to address possible compound additivity of adverse health effects when conducting the risk assessments.

Should you have any questions concerning the contents of this technical memorandum, please contact the undersigned at (619) 405-5436.

Sincerely yours,  
HALEY & ALDRICH, INC.

  
Anita Broughton, REA, CIH  
Risk Assessment Task Manager

  
Scott Zachary  
Project Manager



Attachments:

- Table 1** Groundwater Screening Concentrations
- Appendix A** Input Parameters and Model Results for Derivation of Groundwater Screening Concentrations – Residential Scenario
- Appendix B** Input Parameters and Model Results for Derivation of Groundwater Screening Concentrations – Commercial/Light Industrial Scenario

**TABLE 1. Groundwater Screening Concentrations**  
**BRC Former C-6 Facility, Los Angeles, California**

CAS No.	Chemical	Residential (ug/L)	Commercial/ Light Industrial (ug/L)
79-01-6	Trichloroethylene (TCE)	12500	31600
127-18-4	Tetrachloroethylene (PCE)	3650	9250
75-09-2	Methylene Chloride	131000	333000
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	2860000	6040000
75-35-4	1,1-Dichloroethylene (1,1-DCE)	232	588
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	435000	917000
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	405000	855000
75-01-4	Vinyl Chloride	127	321
75-34-3	1,1 - Dichloroethane (1,1-DCA)	42700	108000
79-00-5	1,1,2 - TCA	25200	63700
71-43-2	Benzene	2050	5180
67-66-3	Chloroform	14500	36800
100-41-4	Ethylbenzene	13000000	27400000
78-93-3	Methyl Ethyl Ketone	773000000	1630000000
1634-04-4	MTBE	655000000	1380000000
91-20-3	Naphthalene	1200000	2540000
108-88-3	Toluene	2000000	4220000
75-69-4	Trichlorofluoromethane (Freon 11)	314000	663000
1330-20-7	Xylenes	5210000	11000000
107-06-2	1,2-Dichloroethane (EDC)	14800	37400
75-71-8	Dichlorodifluoromethane	95000	200000
56-23-5	Carbon tetrachloride	295	747

CAS = Chemical Abstract Service

*Revised April 9, 2001*

**TABLE 1. Groundwater Screening Concentrations**  
**BRG Former C-6 Facility, Los Angeles, California**

CAS No.	Chemical	Residential (ug/L)	Commercial/ Light Industrial (ug/L)
79-01-6	Trichloroethylene (TCE)	12500	31600
127-18-4	Tetrachloroethylene (PCE)	3650	9250
75-09-2	Methylene Chloride	131000	333000
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	2860000	6040000
75-35-4	1,1-Dichloroethylene (1,1-DCE)	232	588
156-59-2	cis-1,2-Dichloroethylene (cis-1,2-DCE)	435000	917000
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	405000	855000
75-01-4	Vinyl Chloride	127	321
75-34-3	1,1 - Dichloroethane (1,1-DCA)	42700	108000
79-00-5	1,1,2 - TCA	25200	63700
71-43-2	Benzene	2050	5180
67-66-3	Chloroform	14500	31600
100-41-4	Ethylbenzene	13000000	9250
78-93-3	Methyl Ethyl Ketone	773000000	333000
1634-04-4	MTBE	655000000	6040000
91-20-3	Naphthalene	1200000	588
108-88-3	Toluene	2000000	917000
75-69-4	Trichlorofluoromethane (Freon 11)	314000	855000
1330-20-7	Xylenes	5210000	321
107-06-2	1,2-Dichloroethane (EDC)	14800	108000
75-71-8	Dichlorodifluoromethane	95000	63700
56-23-5	Carbon tetrachloride	295	5180

CAS = Chemical Abstract Service

Appendix A

## Appendix A

### Input Parameters and Model Results for Derivation of Groundwater Screening Concentrations – Residential Scenario

**SUMMARY OF GROUNDWATER SCREENING CONCENTRATIONS - RESIDENTIAL SCENARIO**  
**BRG Former C-6 Facility, Los Angeles, California**

CAS No.	Chemical	Cancer Risk (=1.0E-06) or Hazard Index (=3.3E-01)	Groundwater Screening Concentration ( $\mu\text{g/L}$ )
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.25E+04
127-18-4	Tetrachloroethylene (PCE)	1.0E-06	3.65E+03
75-09-2	Methylene Chloride	1.0E-06	6.5E-03
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	No Slope Factor	1.31E+05
75-35-4	1,1-Dichloroethylene (1,1-DCE)	1.0E-06	2.86E+06
156-59-2	cis-1,2-Dichloroethylene (cis-1,2-DCE)	No Slope Factor	2.32E+02
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	No Slope Factor	4.35E+05
75-01-4	Vinyl Chloride	1.0E-06	4.05E+05
75-34-3	1,1 - Dichloroethane (1,1-DCA)	1.0E-06	1.27E+02
79-00-5	1,1,2 - TCA	1.0E-06	4.27E+04
71-43-2	Benzene	1.0E-06	2.52E+04
			2.05E+03

Notes:

The indicated groundwater screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of  $1 \times 10^{-6}$  or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of  $1 \times 10^{-6}$  was chosen as the groundwater screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than  $1 \times 10^{-6}$ .

In some cases, calculated groundwater screening concentrations may be greater than the water saturation (solubility) concentration.

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

## Risk Calculations

Page 1-2

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Trichloroethylene (TCE)

Variable Descriptions	Units
<b>CALCULATION OF SOIL GAS CONCENTRATION</b>	
<b>A. SOURCE - Free Product/Soil&gt;100mg/kg.</b>	
Mole fraction	MF = 0.00E+00 dimensionless
Molecular weight	MW = 1.30E+05 mg/mole
Vapor pressure	VP = 7.61E-02 atm
Universal gas constant	R = 8.20E-05 atm-m3/mole-K
Temperature	T = 2.93E+02 K
<b>Calculated soil gas concentration</b>	$C_{sg}(fp) = 0.00E+00 \text{ mg/m}^3$
<b>B. SOURCE - Groundwater</b>	
Water contamination level	$C_w = 1.25E+04 \text{ ug/l}$
Henry's Law Constant	H = 4.20E-01 dimensionless
<b>Calculated soil gas concentration</b>	$C_{sg}(gw) = 5.25E+03 \text{ mg/m}^3$
<b>C. SOURCE - Soil &lt; 100 mg/kg</b>	
Soil contamination level	$C_t = \text{mg/kg}$
Henry's Law Constant	H = 4.20E-01 dimensionless
Bulk density (dry)	$\rho_b = 1.47E+00 \text{ gm/cc}$
Air-filled porosity	$\theta_a = 1.92E-01 \text{ dimensionless}$
Water-filled porosity	$\theta_w = 2.58E-01 \text{ dimensionless}$
Weight fraction of organic carbon	$f_{oc} = 6.45E-02 \text{ dimensionless}$
Organic carbon partition coefficient	$K_{oc} = 9.40E+01 \text{ cm}^3/\text{gm}$
Soil/water distribution coef.	$K_d = 6.07E+00 \text{ cm}^3/\text{gm}$
<b>Calculated soil gas concentration</b>	$C_{sg}(s) = 0.00E+00 \text{ mg/m}^3$
<b>D. SOURCE - Measured Soil Gas</b>	
<b>Measured soil gas concentration</b>	$C_{sg}(m) = \text{mg/m}^3 (\text{ug/l})$
<b>E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS &gt;&gt;&gt;</b>	$5.25E+03 \text{ mg/m}^3$
<b>DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE</b>	
Total porosity	$\theta = 4.51E-01 \text{ dimensionless}$
Air-filled porosity	$\theta_a = 1.92E-01 \text{ dimensionless}$
Diffusion coefficient in air	$D_a = 7.90E-02 \text{ cm}^2/\text{sec}$
<b>Effective diffusion coefficient</b>	$D_e = 1.61E-03 \text{ cm}^2/\text{sec}$
Depth of contamination or Csg	$X = 1.98E+01 \text{ m}$
<b>Calculated Flux</b>	$F_x = 1.54E-01 \text{ mg/m}^2\text{-hour}$

Mole fraction	MF = 0.00E+00 dimensionless
Molecular weight	MW = 1.30E+05 mg/mole
Vapor pressure	VP = 7.61E-02 atm
Universal gas constant	R = 8.20E-05 atm-m3/mole-K
Temperature	T = 2.93E+02 K
<b>Calculated soil gas concentration</b>	$C_{sg}(fp) = 0.00E+00 \text{ mg/m}^3$

Water contamination level	$C_w = 1.25E+04 \text{ ug/l}$
Henry's Law Constant	H = 4.20E-01 dimensionless
<b>Calculated soil gas concentration</b>	$C_{sg}(gw) = 5.25E+03 \text{ mg/m}^3$

Soil contamination level	$C_t = \text{mg/kg}$
Henry's Law Constant	H = 4.20E-01 dimensionless
Bulk density (dry)	$\rho_b = 1.47E+00 \text{ gm/cc}$
Air-filled porosity	$\theta_a = 1.92E-01 \text{ dimensionless}$
Water-filled porosity	$\theta_w = 2.58E-01 \text{ dimensionless}$
Weight fraction of organic carbon	$f_{oc} = 6.45E-02 \text{ dimensionless}$
Organic carbon partition coefficient	$K_{oc} = 9.40E+01 \text{ cm}^3/\text{gm}$
Soil/water distribution coef.	$K_d = 6.07E+00 \text{ cm}^3/\text{gm}$
<b>Calculated soil gas concentration</b>	$C_{sg}(s) = 0.00E+00 \text{ mg/m}^3$

<b>Measured soil gas concentration</b>	$C_{sg}(m) = \text{mg/m}^3 (\text{ug/l})$
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Total porosity	$\theta = 4.51E-01 \text{ dimensionless}$
Air-filled porosity	$\theta_a = 1.92E-01 \text{ dimensionless}$
Diffusion coefficient in air	$D_a = 7.90E-02 \text{ cm}^2/\text{sec}$
<b>Effective diffusion coefficient</b>	$D_e = 1.61E-03 \text{ cm}^2/\text{sec}$
Depth of contamination or Csg	$X = 1.98E+01 \text{ m}$
<b>Calculated Flux</b>	$F_x = 1.54E-01 \text{ mg/m}^2\text{-hour}$

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.26E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>1.26E-03 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.00E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>2.50E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	2.50E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.47E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

## Risk Calculations

Page 1-2

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Tetrachloroethylene (PCE)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.70E+05 mg/mole
Vapor pressure	VP	=	2.43E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	3.65E+03 ug/l
Henry's Law Constant	H	=	7.50E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>2.74E+03 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	7.50E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	2.70E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.74E+01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.74E+03 mg/m3

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.20E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.47E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>7.30E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>5.98E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>5.98E-04 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>4.76E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.19E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.19E-04 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.19E-02</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	4.76E-05 mg/kg-day
Slope factor (potency)	SF	=	2.10E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>9.99E-07</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Methylene Chloride

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	8.50E+04 mg/mole
Vapor pressure	VP	=	5.72E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	1.31E+05 ug/l
Henry's Law Constant	H	=	9.00E-02 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>1.18E+04 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	9.00E-02 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.00E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	6.45E-01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.18E+04 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	1.00E-01 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>2.04E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>4.36E-01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>3.58E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 3.58E-03 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.85E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>7.12E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	7.12E-04 mg/kg-day
Reference dose	RfD	=	1.10E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>6.47E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.85E-04 mg/kg-day
Slope factor (potency)	SF	=	3.50E-03 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>9.96E-07</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** 1,1,1-Trichloroethane (1,1,1-TCA)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	1.63E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	2.86E+06	ug/l
Henry's Law Constant	H	=	7.10E-01	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>2.03E+06</b>	<b>mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	7.10E-01	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.40E+02	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	9.04E+00	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.03E+06 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.80E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.59E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>5.86E+01</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>4.81E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 4.81E-01 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>3.82E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>9.56E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	9.56E-02 mg/kg-day
Reference dose	RfD	=	2.90E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	3.82E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	7.78E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	2.32E+02 ug/l
Henry's Law Constant	H	=	1.10E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>2.55E+02 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.10E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.50E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	4.20E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.55E+02 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	9.00E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.83E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>8.50E-03 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>6.97E-05 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>6.97E-05 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>5.54E-06 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.39E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.39E-05 mg/kg-day
Reference dose	RfD	=	9.10E-03 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.52E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	5.54E-06 mg/kg-day
Slope factor (potency)	SF	=	1.80E-01 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>9.98E-07</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Version: November 1999

## Risk Calculations

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** cis-1,2-Dichloroethylene (cis 1,2-DCE)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	2.40E-04 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	4.35E+05 ug/l
Henry's Law Constant	H	=	1.70E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>7.40E+04 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.70E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	3.60E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	2.32E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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#### E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.40E+04 mg/m3

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.40E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.51E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.03E+00 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.66E-02 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.66E-02 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.32E-03 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>3.30E-03 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	3.30E-03 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.32E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** trans-1,2-Dichloroethylene (trans-1,2-DCE)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	5.20E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	4.05E+05	ug/l
Henry's Law Constant	H	=	3.80E-01	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>1.54E+05</b>	<b>mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	3.80E-01	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	3.80E+01	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	2.45E+00	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.54E+05 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.10E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.45E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>4.04E+00</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

## Risk Calculations

Page 2-2

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>3.32E-02 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 3.32E-02 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.64E-03 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>6.59E-03 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	6.59E-03 mg/kg-day
Reference dose	RfD	=	2.00E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.64E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Version: November 1999

## Risk Calculations

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Vinyl Chloride

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### **A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	6.30E+04 mg/mole
Vapor pressure	VP	=	3.50E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### **B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	1.27E+02 ug/l
Henry's Law Constant	H	=	1.10E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>1.40E+02 mg/m3</b>

#### **C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.10E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.90E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.23E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### **D. SOURCE - Measured Soil Gas**

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.40E+02 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	1.10E-01 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>2.24E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>5.69E-03 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>4.66E-05 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>4.66E-05 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>3.71E-06 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>9.27E-06 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	9.27E-06 mg/kg-day
Reference dose	RfD	=	7.43E-03 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.25E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	3.71E-06 mg/kg-day
Slope factor (potency)	SF	=	2.70E-01 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** 1,1 - Dichloroethane (1,1-DCA)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.90E+04	mg/mole
Vapor pressure	VP	=	3.08E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	4.27E+04	ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>9.82E+03</b>	<b>mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	5.30E+01	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	3.42E+00	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 9.82E+03 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.40E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.51E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.69E-01</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>2.20E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>2.20E-03 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.75E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>4.39E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	4.39E-04 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.13E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.75E-04 mg/kg-day
Slope factor (potency)	SF	=	5.70E-03 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

**SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL**

Page 1-2

**Risk Calculations**

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** 1,1,2 - TCA

<b>Variable Descriptions</b>	<b>Units</b>
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**CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	3.10E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

**B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	2.52E+04 ug/l
Henry's Law Constant	H	=	3.70E-02 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>9.32E+02 mg/m3</b>

**C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	3.70E-02 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	9.50E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.45E-02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	6.13E-03 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

**D. SOURCE - Measured Soil Gas**

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 9.32E+02 mg/m3****DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.80E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.59E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.69E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>2.21E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>2.21E-04 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.76E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>4.39E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	4.39E-05 mg/kg-day
Reference dose	RfD	=	4.00E-03 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.10E-02</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.76E-05 mg/kg-day
Slope factor (potency)	SF	=	5.70E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

**SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL**

Page 1-2

**Risk Calculations**

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Benzene

<b>Variable Descriptions</b>	<b>Units</b>
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**CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	7.80E+04 mg/mole
Vapor pressure	VP	=	1.25E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

**B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	2.05E+03 ug/l
Henry's Law Constant	H	=	2.30E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>4.72E+02 mg/m3</b>

**C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	2.30E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.20E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	4.00E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

**D. SOURCE - Measured Soil Gas**

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.72E+02 mg/m3****DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.80E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.79E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.54E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Version: November 1999

## Risk Calculations

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.26E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>1.26E-04 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.00E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>2.50E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	2.50E-05 mg/kg-day
Reference dose	RfD	=	1.70E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.47E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.00E-05 mg/kg-day
Slope factor (potency)	SF	=	1.00E-01 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>



**CHEMICAL PARAMETERS**

CAS No.	MW (mg/mole)	H <sup>r</sup> (dimension-less)	Da (cm <sup>2</sup> /sec)	VP (atm)	Temp. (°C)	K <sub>oc</sub> (cm <sup>3</sup> /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) <sup>1</sup>	Chronic RfD (inh) (mg/kg-day)	
									Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) <sup>1</sup>
79-01-6	Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	7.9E-02	20	b	9.4E+01	a	1.1E+03
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	7.2E-02	25	b	2.7E+02	a	2.0E+02
75-09-2	Methylene Chloride	8.5E+04	a	9.0E-02	1.0E-01	25	b	1.0E+01	a	3.5E+03
71-11-6	1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	7.8E-02	25	b	1.4E+02	a	1.1E+01
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	9.0E-02	25	b	6.5E+01	a	1.3E+03
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	7.4E-02	20	b	3.6E+01	a	1.0E+02
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	7.1E-02	30	b	3.8E+01	a	6.3E+03
75-01-4	Vinyl Chloride	6.3E+04	a	1.1E+00	1.1E-01	25	b	1.9E+01	a	2.80E+03
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	7.4E-02	25	b	5.3E+01	a	5.1E+03
79-00-5	1,1,2 - TCA	1.3E+05	a	3.7E-02	7.8E-02	25	b	7.5E+01	a	4.4E+03
71-43-2	Benzene	7.8E+04	a	2.3E-01	8.8E-02	25	b	6.2E+01	a	1.8E+03
67-66-3	Chloroform	1.2E+05	a	1.5E-01	1.0E-01	25	b	5.3E+01	a	1.0E-01
100-41-4	Ethylbenzene	1.1E+05	a	3.2E-01	7.5E-02	25	b	1.3E-02	a	1.7E+02
78-93-3	Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	9.0E-02	25	b	1.2E-01	a	5.7E-03
1634-04-4	MTBE	8.5E+04	a	2.4E-02	8.0E-02	25	b	3.3E-01	a	2.7E-05
91-20-3	Naphthalene	1.3E+05	a	2.0E-02	5.9E-02	1.0E-04	b	6.0E+00	a	1.5E+05
108-88-3	Toluene	9.2E+04	a	2.7E-01	8.7E-02	25	b	1.0E+03	a	3.1E+01
75-69-4	Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	8.7E-02	25	b	1.6E+02	a	1.1E+03
1330-20-7	Xylenes	1.1E+05	a	3.0E-01	7.0E-02	25	b	1.1E-02	a	2.0E+02
107-06-2	1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	1.0E-01	25	b	1.1E-01	a	8.5E+03
75-71-8	Dichlorodifluoromethane	1.2E+05	a	4.1E+00	8.0E-02	21	b	5.8E+01	a	2.8E+02
56-23-5	Carbon tetrachloride	1.5E+05	a	1.2E+00	7.8E-02	1.5E-01	b	1.5E+02	a	7.9E+02

References:

- a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
- b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>
- c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
- d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, [http://risk.lsd.orri.gov/cgi-bin/risk/TOX\\_select?select=csf](http://risk.lsd.orri.gov/cgi-bin/risk/TOX_select?select=csf)
- e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/arb2588/riskassess.htm>

Toxicity Value reference priority:

1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/arb2588/riskassess.htm>
3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

**SUMMARY OF GROUNDWATER SCREENING CONCENTRATIONS - RESIDENTIAL SCENARIO**  
**BRCA Former C-6 Facility, Los Angeles, California**

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Groundwater Screening Concentration (ug/L)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.5E-03	1.25E+04
67-66-3	Chloroform	1.0E-06	1.5E-03	1.45E+04
100-41-4	Ethylbenzene	No Slope Factor	3.3E-01	1.30E+07
78-93-3	Methyl Ethyl Ketone	No Slope Factor	3.3E-01	7.73E+08
1634-04-4	MTBE	No Slope Factor	3.3E-01	6.55E+08
91-20-3	Naphthalene	No Slope Factor	3.3E-01	1.20E+06
108-88-3	Toluene	No Slope Factor	3.3E-01	2.00E+06
75-69-4	Trichlorofluoromethane (Freon 11)	No Slope Factor	3.3E-01	3.14E+05
1330-20-7	Xylenes	No Slope Factor	3.3E-01	5.21E+06
107-06-2	1,2-Dichloroethane (EDC)	1.0E-06	1.3E-03	1.48E+04
75-71-8	Dichlorodifluoromethane	No Slope Factor	3.3E-01	9.50E+04
56-23-5	Carbon tetrachloride	1.0E-06	2.4E-02	2.95E+02

**Notes:**

The indicated groundwater screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of  $1 \times 10^{-6}$  or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of  $1 \times 10^{-6}$  was chosen as the groundwater screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than  $1 \times 10^{-6}$ .

In some cases, calculated groundwater screening concentrations may be greater than the water saturation (solubility) concentration.

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Trichloroethlyene (TCE)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	1.25E+04	ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>5.25E+03</b>	<b>mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	9.40E+01	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	6.07E+00	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.25E+03 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.90E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.61E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.54E-01</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Version: November 1999

## Risk Calculations

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.26E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.26E-03 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.00E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>2.50E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	2.50E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.47E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Chloroform

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.20E+05 mg/mole
Vapor pressure	VP	=	2.59E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	1.45E+04 ug/l
Henry's Law Constant	H	=	1.50E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>2.18E+03 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.50E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	5.30E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	3.42E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.18E+03 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	1.00E-01 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>2.04E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>8.05E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>6.60E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>6.60E-04 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>5.25E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.31E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.31E-04 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.53E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	5.25E-05 mg/kg-day
Slope factor (potency)	SF	=	1.90E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>9.98E-07</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Ethylbenzene

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.10E+05 mg/mole
Vapor pressure	VP	=	1.26E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	<b>=</b>	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	1.30E+07 ug/l
Henry's Law Constant	H	=	3.20E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	<b>=</b>	<b>4.16E+06 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	3.20E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	2.00E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.29E+01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	<b>=</b>	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.16E+06 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.50E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	<b>=</b>	<b>1.53E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	<b>=</b>	<b>1.15E+02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>9.47E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 9.47E-01 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>7.53E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.88E-01 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.88E-01 mg/kg-day
Reference dose	RfD	=	5.70E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	7.53E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methyl Ethyl Ketone

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	7.20E+04 mg/mole
Vapor pressure	VP	=	1.20E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	7.73E+08 ug/l
Henry's Law Constant	H	=	1.10E-03 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>8.50E+05 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.10E-03 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	9.50E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.45E-02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	6.13E-03 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> **8.50E+05 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	9.00E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.83E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.83E+01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>2.32E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>2.32E-01 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
 <b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.85E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>4.62E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	4.62E-02 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.85E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** MTBE

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	8.50E+04 mg/mole
Vapor pressure	VP	=	3.29E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	6.55E+08 ug/l
Henry's Law Constant	H	=	2.40E-02 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>1.57E+07 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	2.40E-02 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.00E+00 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	3.87E-01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.57E+07 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.00E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.63E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>4.65E+02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
Indoor air component	C <sub>i</sub>	=	3.82E+00 mg/m <sup>3</sup>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C <sub>o</sub>	=	0.00E+00 mg/m <sup>3</sup>

#### C. TOTAL INDOOR AIR CONCENTRATION

	C <sub>t</sub>	=	3.82E+00 mg/m <sup>3</sup>
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### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT <sub>c</sub>	=	3.04E-01 mg/kg-day
Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	7.59E-01 mg/kg-day

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	7.59E-01 mg/kg-day
Reference dose	RfD	=	2.30E+00 mg/kg-day
Hazard Index	HI	=	3.30E-01

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	3.04E-01 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Naphthalene

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	1.00E-04	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	1.20E+06	ug/l
Henry's Law Constant	H	=	2.00E-02	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>2.40E+04</b>	<b>mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	2.00E-02	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.20E+03	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	7.75E+01	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.40E+04 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	5.90E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.20E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>5.24E-01</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>4.30E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>4.30E-03 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>3.42E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>8.55E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	8.55E-04 mg/kg-day
Reference dose	RfD	=	2.60E-03 mg/kg-day
Hazard Index	HI	=	3.29E-01

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	3.42E-04 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Toluene

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.20E+04	mg/mole
Vapor pressure	VP	=	3.74E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	2.00E+06	ug/l
Henry's Law Constant	H	=	2.70E-01	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>5.40E+05</b>	<b>mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	2.70E-01	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	9.50E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.45E-02	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	6.13E-03	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.40E+05 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.70E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.77E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.74E+01</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	<b>1.00E-02</b> m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	<b>2.44E+00</b> m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	<b>1.22E+00</b> m <sup>3</sup> /hr
<b>Indoor air component</b>	C <sub>i</sub>	=	<b>1.43E-01</b> mg/m <sup>3</sup>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	C <sub>o</sub>	=	<b>0.00E+00</b> mg/m <sup>3</sup>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	C <sub>t</sub>	=	<b>1.43E-01</b> mg/m <sup>3</sup>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	<b>1.22E+01</b> m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	<b>1.00E+00</b> hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	<b>3.50E+02</b> days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	<b>1.10E+04</b> days
<b>Chemical Intake (carc. risk)</b>	IT <sub>c</sub>	=	<b>1.13E-02</b> mg/kg-day
<b>Chemical Intake (non-carc. risk)</b>	IT <sub>nc</sub>	=	<b>2.84E-02</b> mg/kg-day

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	2.84E-02 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.13E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	Risk	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Trichlorofluoromethane (Freon 11)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.40E+05 mg/mole
Vapor pressure	VP	=	1.05E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	3.14E+05 ug/l
Henry's Law Constant	H	=	4.00E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>1.26E+06 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	4.00E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.60E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.03E+01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.26E+06 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.70E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.77E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>4.04E+01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>3.32E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>3.32E-01 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.64E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>6.59E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	6.59E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.64E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Xylenes

<b>Variable Descriptions</b>	<b>Units</b>
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.10E+05 mg/mole
Vapor pressure	VP	=	1.05E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	5.21E+06 ug/l
Henry's Law Constant	H	=	3.00E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>1.56E+06 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	3.00E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	2.00E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.29E+01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.56E+06 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.00E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.43E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>4.05E+01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>3.32E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>3.32E-01 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.64E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>6.60E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	6.60E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.64E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** 1,2-Dichloroethane (EDC)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### **A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.90E+04	mg/mole
Vapor pressure	VP	=	1.14E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### **B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	1.48E+04	ug/l
Henry's Law Constant	H	=	4.00E-02	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>5.92E+02</b>	<b>mg/m3</b>

#### **C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	4.00E-02	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	3.80E+01	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	2.45E+00	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### **D. SOURCE - Measured Soil Gas**

Measured soil gas concentration	C <sub>sg</sub> (m)	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.92E+02 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	1.00E-01	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>2.04E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.19E-02</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.80E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.80E-04 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.43E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>3.57E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	3.57E-05 mg/kg-day
Reference dose	RfD	=	2.70E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.32E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.43E-05 mg/kg-day
Slope factor (potency)	SF	=	7.00E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Dichlorodifluoromethane

Variable Descriptions	Units
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## CALCULATION OF SOIL GAS CONCENTRATION

### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	5.77E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	9.50E+04	ug/l
Henry's Law Constant	H	=	4.10E+00	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>3.90E+05</b>	<b>mg/m3</b>

### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	4.10E+00	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	5.80E+01	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	3.74E+00	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> **3.90E+05 mg/m3**

## DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.00E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.63E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.15E+01</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>9.45E-02 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>9.45E-02 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>7.52E-03 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.88E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.88E-02 mg/kg-day
Reference dose	RfD	=	5.70E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	7.52E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Version: November 1999

## Risk Calculations

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Carbon tetrachloride

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.50E+05 mg/mole
Vapor pressure	VP	=	1.51E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	2.95E+02 ug/l
Henry's Law Constant	H	=	1.20E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>3.54E+02 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.20E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.50E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	9.68E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.54E+02 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.80E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.59E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.02E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>8.38E-05 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>8.38E-05 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m <sup>3</sup> /hr
Inhalation rate	IR	=	1.22E+01 m <sup>3</sup> /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>6.67E-06 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.67E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.67E-05 mg/kg-day
Reference dose	RfD	=	6.86E-04 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>2.43E-02</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	6.67E-06 mg/kg-day
Slope factor (potency)	SF	=	1.50E-01 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

## GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f <sub>oc</sub> (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
I-34-20	1/22/2001	20	Silt	1.51	24.1	0.45	0.10	0.36	500	0.05
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-004 (I-34-20)	1/29/2001	20	Silt	1.54	17.5	0.42	0.15	0.27	330	0.03
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	1.35	4.4	0.51	0.45	0.06	230	0.02
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA290176-012 (D-29-20)	1/29/2001	20	Silt	1.55	17.0	0.41	0.15	0.26	430	0.04
EIA290176-015 (D-29-50)	1/29/2001	50	Fine sand	1.36	19.5	0.49	0.22	0.26	560	0.06
EIA290176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
EIA290176-021 (I-25-20)	1/29/2001	20	Silt	1.37	20.2	0.48	0.20	0.28	410	0.04
EIA290176-024 (I-25-50)	1/29/2001	50	Silt	1.34	24.3	0.51	0.18	0.32	470	0.05

**Average**

1.47	0.45	0.19	0.26

Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

\* f<sub>oc</sub> = the weight fraction of organic carbon in soil = TOC/10,000

**CHEMICAL PARAMETERS**

CAS No.	MW (mg/mole)	H <sup>+</sup> (dimension-less)	Da (cm <sup>2</sup> /sec)	VP (atm)	Temp. (°C)	K <sub>oc</sub> (cm <sup>3</sup> /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) <sup>-1</sup>	Chronic RD (inh) (mg/kg-day)
79-01-6 Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	7.9E-02	a	7.6E-02	20 b	9.4E+01	a
127-18-4 Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	7.2E-02	a	2.4E-02	25 b	2.7E+02	a
75-09-2 Methylene Chloride	8.5E+04	a	9.0E-02	1.0E-01	a	5.7E-01	25 b	1.0E+01	a
71-55-6 1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	7.8E-02	a	1.6E-01	25 b	1.4E+02	a
75-35-4 1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	9.0E-02	a	7.8E-01	25 b	6.5E+01	a
156-59-2 cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	7.4E-02	a	2.4E-04	20 b	3.6E+01	a
156-60-5 trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	7.1E-02	a	5.2E-01	30 b	3.8E+01	a
75-01-4 Vinyl Chloride	6.3E+04	a	1.1E+00	1.1E-01	a	3.5E+00	25 b	1.9E+01	a
75-34-3 1,1-Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	7.4E-02	a	3.1E-01	25 b	5.3E+01	a
79-00-5 1,1,2-TCA	1.3E+05	a	3.7E-02	7.8E-02	a	3.1E-02	25 b	7.5E+01	a
71-43-2 Benzene	7.8E+04	a	2.3E-01	8.8E-02	a	1.2E-01	25 b	6.2E+01	a
67-66-3 Chloroform	1.2E+05	a	1.5E-01	1.0E-01	a	2.6E-01	25 b	3.5E+01	a
100-41-4 Ethylbenzene	1.1E+05	a	3.2E-01	7.5E-02	a	1.3E-02	25 b	2.0E+02	a
78-93-3 Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	9.0E-02	a	1.2E-01	25 b	4.5E+00	a
1634-04-4 MTBE	8.5E+04	a	2.4E-02	8.0E-02	a	3.3E-01	25 b	6.0E+00	a
91-20-3 Naphthalene	1.3E+05	a	2.0E-02	5.9E-02	a	1.0E-04	b	1.2E+03	a
108-88-3 Toluene	9.2E+04	a	2.7E-01	8.7E-02	a	3.7E-02	25 b	1.4E+02	a
75-69-4 Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	8.7E-02	a	1.0E+00	25 b	1.6E+02	a
1330-20-7 Xylenes	1.1E+05	a	3.0E-01	7.0E-02	a	1.1E-02	25 b	2.0E+02	a
107-06-2 1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	1.0E-01	a	1.1E-01	25 b	3.8E+01	a
75-71-8 Dichlorodifluoromethane	1.2E+05	a	4.1E+00	8.0E-02	a	5.8E+00	21 b	5.8E+01	a
56-23-5 Carbon tetrachloride	1.5E+05	a	1.2E+00	7.8E-02	a	1.5E-01	25 b	1.5E+02	a

References:

a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.ncbi.nlm.nih.gov/pubs/factsheets/factsheets.html>.

c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalIDB/index.asp>

d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, [http://risk.isd.ornl.gov/cgi-bin/tox/TOX\\_select?selected=csf](http://risk.isd.ornl.gov/cgi-bin/tox/TOX_select?selected=csf)

e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/risksassess.htm>

Toxicity Value reference priority:

1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalIDB/index.asp>

2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/risksassess.htm>

3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

Appendix B

## Appendix B

### Input Parameters and Model Results for Derivation of Groundwater Screening Concentrations – Commercial/Light Industrial Scenario

**SUMMARY OF GROUNDWATER SCREENING CONCENTRATIONS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO**  
**BRC Former C-6 Facility, Los Angeles, California**

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Groundwater Screening Concentration (ug/L)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.8E-03	3.16E+04
127-18-4	Tetrachloroethylene (PCE)	1.0E-06	1.4E-02	9.25E+03
75-09-2	Methylene Chloride	1.0E-06	7.8E-03	3.33E+05
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	No Slope Factor	3.3E-01	6.04E+06
75-35-4	1,1-Dichloroethylene (1,1-DCE)	1.0E-06	1.8E-03	5.88E+02
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	No Slope Factor	3.3E-01	9.17E+05
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	No Slope Factor	3.3E-01	8.55E+05
75-01-4	Vinyl Chloride	1.0E-06	1.5E-03	3.21E+02
75-34-3	1,1 - Dichloroethane (1,1-DCA)	1.0E-06	3.8E-03	1.08E+05
79-00-5	1,1,2 - TCA	1.0E-06	1.3E-02	6.37E+04
71-43-2	Benzene	1.0E-06	1.8E-03	5.18E+03

Notes:

The indicated groundwater screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of  $1 \times 10^{-6}$  or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of  $1 \times 10^{-6}$  was chosen as the groundwater screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than  $1 \times 10^{-6}$ .

In some cases, calculated groundwater screening concentrations may be greater than the water saturation (solubility) concentration.

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Trichloroethylene (TCE)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### **A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	7.61E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### **B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	3.16E+04 ug/l
Henry's Law Constant	H	=	4.20E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>1.33E+04 mg/m3</b>

#### **C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	4.20E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	9.40E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	6.07E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### **D. SOURCE - Measured Soil Gas**

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.33E+04 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.90E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.61E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>3.88E-01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.92E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.92E-03 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.00E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>3.00E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	3.00E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.76E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Tetrachloroethylene (PCE)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.70E+05 mg/mole
Vapor pressure	VP	=	2.43E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	<b>=</b>	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	9.25E+03 ug/l
Henry's Law Constant	H	=	7.50E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	<b>=</b>	<b>6.94E+03 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	7.50E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	2.70E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.74E+01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	<b>=</b>	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 6.94E+03 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.20E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	<b>=</b>	<b>1.47E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	<b>=</b>	<b>1.85E-01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>9.13E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m

#### Outdoor air component

$$C_o = 0.00E+00 \text{ mg/m}^3$$

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 9.13E-04 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>4.76E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.43E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.43E-04 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.43E-02</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	4.76E-05 mg/kg-day
Slope factor (potency)	SF	=	2.10E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Methylene Chloride

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	8.50E+04 mg/mole
Vapor pressure	VP	=	5.72E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	3.33E+05 ug/l
Henry's Law Constant	H	=	9.00E-02 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>3.00E+04 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	9.00E-02 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.00E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	6.45E-01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.00E+04 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	1.00E-01 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>2.04E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.11E+00 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>5.48E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 5.48E-03 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.86E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>8.58E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	8.58E-04 mg/kg-day
Reference dose	RfD	=	1.10E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>7.80E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.86E-04 mg/kg-day
Slope factor (potency)	SF	=	3.50E-03 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,1-Trichloroethane (1,1,1-TCA)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	1.63E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	6.04E+06 ug/l
Henry's Law Constant	H	=	7.10E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>4.29E+06 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	7.10E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.40E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	9.04E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.29E+06 mg/m3

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.80E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.59E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.24E+02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>6.11E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 6.11E-01 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>3.19E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>9.57E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	9.57E-02 mg/kg-day
Reference dose	RfD	=	2.90E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	3.19E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	7.78E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	5.88E+02 ug/l
Henry's Law Constant	H	=	1.10E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>6.47E+02 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.10E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.50E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	4.20E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 6.47E+02 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	9.00E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.83E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.15E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.06E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>1.06E-04 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>5.55E-06 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.67E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.67E-05 mg/kg-day
Reference dose	RfD	=	9.10E-03 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.83E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	5.55E-06 mg/kg-day
Slope factor (potency)	SF	=	1.80E-01 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>9.99E-07</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** cis-1,2-Dichloroethylene (cis 1,2-DCE)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	2.40E-04 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	9.17E+05 ug/l
Henry's Law Constant	H	=	1.70E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>1.56E+05 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.70E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	3.60E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	2.32E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.56E+05 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.40E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.51E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>4.27E+00 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>2.11E-02 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>2.11E-02 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.10E-03 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>3.30E-03 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	3.30E-03 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.10E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** trans-1,2-Dichloroethylene (trans-1,2-DCE)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	5.20E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	8.55E+05 ug/l
Henry's Law Constant	H	=	3.80E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>3.25E+05 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	3.80E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.45E-02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	4.17E-03 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.25E+05 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.10E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.45E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>8.54E+00 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>4.22E-02 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>4.22E-02 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.20E-03 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>6.60E-03 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	6.60E-03 mg/kg-day
Reference dose	RfD	=	2.00E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.20E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Vinyl Chloride

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	6.30E+04 mg/mole
Vapor pressure	VP	=	3.50E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	3.21E+02 ug/l
Henry's Law Constant	H	=	1.10E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>3.53E+02 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.10E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.90E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.23E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.53E+02 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	1.10E-01 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>2.24E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.44E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>7.10E-05 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

	C <sub>t</sub>	=	7.10E-05 mg/m <sup>3</sup>
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### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>3.70E-06 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.11E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.11E-05 mg/kg-day
Reference dose	RfD	=	7.43E-03 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.50E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	3.70E-06 mg/kg-day
Slope factor (potency)	SF	=	2.70E-01 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** 1,1 - Dichloroethane (1,1-DCA)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.90E+04 mg/mole
Vapor pressure	VP	=	3.08E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	1.08E+05 ug/l
Henry's Law Constant	H	=	2.30E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>2.48E+04 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	2.30E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	5.30E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	3.42E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.48E+04 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.40E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.51E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>6.80E-01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>3.36E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

	C <sub>t</sub>	=	3.36E-03 mg/m <sup>3</sup>
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### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.75E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>5.26E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	5.26E-04 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.76E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.75E-04 mg/kg-day
Slope factor (potency)	SF	=	5.70E-03 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>9.99E-07</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Version: November 1999

## Risk Calculations

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** 1,1,2 - TCA

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### **A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	3.10E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### **B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	6.37E+04 ug/l
Henry's Law Constant	H	=	3.70E-02 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>2.36E+03 mg/m3</b>

#### **C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	3.70E-02 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	7.50E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	4.84E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### **D. SOURCE - Measured Soil Gas**

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.36E+03 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.80E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.59E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>6.80E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	<b>1.00E-02</b> m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	<b>2.44E+00</b> m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	<b>2.03E+00</b> m <sup>3</sup> /hr
<b>Indoor air component</b>	C <sub>i</sub>	=	<b>3.36E-04</b> mg/m <sup>3</sup>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	C <sub>o</sub>	=	<b>0.00E+00</b> mg/m <sup>3</sup>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	C <sub>t</sub>	=	<b>3.36E-04</b> mg/m <sup>3</sup>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	<b>4.80E+01</b> m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	<b>3.33E-01</b> hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	<b>2.50E+02</b> days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	<b>9.13E+03</b> days
<b>Chemical Intake (carc. risk)</b>	IT <sub>c</sub>	=	<b>1.75E-05</b> mg/kg-day
<b>Chemical Intake (non-carc. risk)</b>	IT <sub>nc</sub>	=	<b>5.26E-05</b> mg/kg-day

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	5.26E-05 mg/kg-day
Reference dose	RfD	=	4.00E-03 mg/kg-day
<b>Hazard Index</b>	HI	=	<b>1.32E-02</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.75E-05 mg/kg-day
Slope factor (potency)	SF	=	5.70E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	Risk	=	<b>9.99E-07</b>

**SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL**

Page 1-2

**Risk Calculations**

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Benzene**Variable Descriptions** **Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	7.80E+04 mg/mole
Vapor pressure	VP	=	1.25E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

**B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	5.18E+03 ug/l
Henry's Law Constant	H	=	2.30E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>1.19E+03 mg/m3</b>

**C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	2.30E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.20E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	4.00E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

**D. SOURCE - Measured Soil Gas**

<b>Measured soil gas concentration</b>	<b>C<sub>sg</sub>(m)</b>	=	<b>mg/m3 (ug/l)</b>
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.19E+03 mg/m3****DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.80E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.79E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>3.88E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.92E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.92E-04 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.00E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>3.00E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	3.00E-05 mg/kg-day
Reference dose	RfD	=	1.70E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.76E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.00E-05 mg/kg-day
Slope factor (potency)	SF	=	1.00E-01 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

## GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	$f_{oc}$ (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
I-34-20	1/22/2001	20	Silt	1.51	24.1	0.45	0.10	0.36	500	0.05
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-004 (I-34-20)	1/29/2001	20	Silt	1.54	17.5	0.42	0.15	0.27	330	0.03
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	1.35	4.4	0.51	0.45	0.06	230	0.02
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA290176-012 (D-29-20)	1/29/2001	20	Silt	1.55	17.0	0.41	0.15	0.26	430	0.04
EIA29176-015 (D-29-50)	1/29/2001	50	Fine sand	1.36	19.5	0.49	0.22	0.26	560	0.06
EIA29176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
EIA29176-021 (I-25-20)	1/29/2001	20	Silt	1.37	20.2	0.48	0.20	0.28	410	0.04
EIA29176-024 (I-25-50)	1/29/2001	50	Silt	1.34	24.3	0.51	0.18	0.32	470	0.05

**Average**

0.45	0.19	0.26	645	0.06
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Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

\*  $f_{oc}$  = the weight fraction of organic carbon in soil = TOC/10,000

**CHEMICAL PARAMETERS**

CAS No.	MW (mg/mole)	H' (dimension-less)	Da (cm <sup>2</sup> /sec)	VP (atm)	Temp. (°C)	K <sub>oc</sub> (cm <sup>3</sup> /g)	Water Solubility (mg/L <sub>water</sub> )	CSF (inh) (mg/kg-day) <sup>-1</sup>	Chronic RfD (inh) (mg/kg-day)	
									Water Solubility (mg/L <sub>water</sub> )	CSF (inh) (mg/kg-day) <sup>-1</sup>
79-01-6 Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	20	b	9.4E+01	a	1.1E+03
127-18-4 Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	25	b	2.4E+02	a	2.0E+02
75-09-2 Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	25	b	1.0E+01	a	1.3E+04
71-55-6 1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	a	7.8E-02	25	b	1.4E+02	a	1.3E+03
75-35-4 1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	25	b	6.5E+01	a	2.3E+03
93E+04 a	1.7E-01	a	7.4E-02	a	2.4E-04	20	b	3.6E+01	a	3.5E+03
156-59-2 cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	3.8E-01	a	7.1E-02	30	b	3.8E+01	a	6.3E+03
156-60-5 trans-1,2-Dichloroethylene (trans-1,2-DCE)	6.3E+04	a	1.1E+00	a	1.1E-01	25	b	1.9E+01	a	2.80E+03
75-01-4 Vinyl Chloride	9.9E+04	a	2.3E-01	a	7.4E-02	31	b	5.3E+01	a	2.7E+01
75-34-3 1,1 - Dichloroethane (1,1-DCA)	9.3E+04	a	3.7E-02	a	7.8E-02	25	b	7.5E+01	a	5.1E+03
79-00-5 1,1,2 - TCA	7.8E+04	a	2.3E-01	a	8.8E-02	25	b	6.2E+01	a	4.4E+03
71-43-2 Benzene	1.2E+05	a	1.5E-01	a	1.0E-01	25	b	5.3E+01	a	1.8E+03
67-66-3 Chloroform	1.1E+05	a	3.2E-01	a	7.5E-02	25	b	1.3E-02	a	7.9E+03
100-41-4 Ethylbenzene	7.2E+04	a	1.1E-03	a	9.0E-02	25	b	1.2E-01	a	1.7E+02
78-93-3 Methyl Ethyl Ketone	8.5E+04	a	2.4E-02	a	8.0E-02	33	b	3.3E-01	a	4.4E+03
1634-04-4 MTBE	1.3E+05	a	2.0E-02	a	5.9E-02	25	b	1.0E-04	a	1.8E+03
91-20-3 Naphthalene	9.2E+04	a	2.7E-01	a	8.7E-02	25	b	3.7E-02	a	1.9E-02
108-88-3 Toluene	1.4E+05	a	4.0E+00	a	8.7E-02	25	b	1.0E+00	a	2.0E+02
75-69-4 Trichlorofluoromethane (Freon 11)	1.1E+05	a	3.0E-01	a	7.0E-02	25	b	1.1E-02	a	1.6E+02
1330-20-7 Xylenes	9.9E+04	a	4.0E-02	a	1.0E-01	25	b	3.8E+01	a	8.5E+03
107-06-2 1,2-Dichloroethane (EDC)	1.2E+05	a	4.1E+00	a	8.0E-02	21	b	5.8E+01	a	2.8E+02
75-71-8 Dichlorodifluoromethane	1.5E+05	a	1.2E+00	a	7.8E-02	25	b	1.5E+01	a	7.9E+02
56-23-5 Carbon tetrachloride										1.5E+01

References:

- a EPA Region 9 Preliminary Remediation Goals (PRGs), 2000.
- b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>
- c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
- d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, [http://risk.lsd.oni.gov/cgi-bin/toxTOX\\_select?select=csf](http://risk.lsd.oni.gov/cgi-bin/toxTOX_select?select=csf)
- e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
- Toxicity Value reference priority:
  1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
  2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
  3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

**SUMMARY OF GROUNDWATER SCREENING CONCENTRATIONS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO**  
**BRC Former C-6 Facility, Los Angeles, California**

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Groundwater Screening Concentration ( $\mu\text{g/L}$ )
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.8E-03	3.16E+04
67-66-3	Chloroform	1.0E-06	1.8E-03	3.68E+04
100-41-4	Ethylbenzene	No Slope Factor	3.3E-01	2.74E+07
78-93-3	Methyl Ethyl Ketone	No Slope Factor	3.3E-01	1.63E+09
1634-04-4	MTBE	No Slope Factor	3.3E-01	1.38E+09
91-20-3	Naphthalene	No Slope Factor	3.3E-01	2.54E+06
108-88-3	Toluene	No Slope Factor	3.3E-01	4.22E+06
75-69-4	Trichlorofluoromethane (Freon 11)	No Slope Factor	3.3E-01	6.63E+05
1330-20-7	Xylenes	No Slope Factor	3.3E-01	1.10E+07
107-06-2	1,2-Dichloroethane (EDC)	1.0E-06	1.6E-03	3.74E+04
75-71-8	Dichlorofluoromethane	No Slope Factor	3.3E-01	2.00E+05
56-23-5	Carbon tetrachloride	1.0E-06	2.9E-02	7.47E+02

Notes:

The indicated groundwater screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of  $1 \times 10^{-6}$  or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of  $1 \times 10^{-6}$  was chosen as the groundwater screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than  $1 \times 10^{-6}$ .

In some cases, calculated groundwater screening concentrations may be greater than the water saturation (solubility) concentration.

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Trichloroethylene (TCE)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	7.61E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	3.16E+04 ug/l
Henry's Law Constant	H	=	4.20E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>1.33E+04 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	4.20E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	9.40E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	6.07E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.33E+04 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.90E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.61E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>3.88E-01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.92E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

	C <sub>t</sub>	=	1.92E-03 mg/m <sup>3</sup>
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### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.00E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>3.00E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	3.00E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.76E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Chloroform

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.20E+05 mg/mole
Vapor pressure	VP	=	2.59E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	3.68E+04 ug/l
Henry's Law Constant	H	=	1.50E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>5.52E+03 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.50E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	5.30E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	3.42E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.52E+03 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	1.00E-01 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>2.04E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.04E-01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.01E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.01E-03 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>5.26E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.58E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.58E-04 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.84E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	5.26E-05 mg/kg-day
Slope factor (potency)	SF	=	1.90E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Ethylbenzene

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.10E+05	mg/mole
Vapor pressure	VP	=	1.26E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	2.74E+07	ug/l
Henry's Law Constant	H	=	3.20E-01	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>8.77E+06</b>	<b>mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	3.20E-01	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	2.00E+02	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.29E+01	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### D. SOURCE - Measured Soil Gas

<b>Measured soil gas concentration</b>	<b>C<sub>sg</sub>(m)</b>	=	<b>mg/m3 (ug/l)</b>
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 8.77E+06 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.50E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.53E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.43E+02</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.20E+00 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>1.20E+00 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>6.27E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.88E-01 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.88E-01 mg/kg-day
Reference dose	RfD	=	5.70E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	6.27E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Methyl Ethyl Ketone

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	7.20E+04 mg/mole
Vapor pressure	VP	=	1.20E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	1.63E+09 ug/l
Henry's Law Constant	H	=	1.10E-03 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>1.79E+06 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.10E-03 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	4.50E+00 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	2.90E-01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.79E+06 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	9.00E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.83E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>5.97E+01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>2.95E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 2.95E-01 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.54E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>4.62E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	4.62E-02 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.54E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** MTBE

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	8.50E+04 mg/mole
Vapor pressure	VP	=	3.29E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	1.38E+09 ug/l
Henry's Law Constant	H	=	2.40E-02 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>3.31E+07 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	2.40E-02 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	6.00E+00 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	3.87E-01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.31E+07 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.00E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.63E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>9.81E+02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>4.84E+00 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>4.84E+00 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.53E-01 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>7.58E-01 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	7.58E-01 mg/kg-day
Reference dose	RfD	=	2.30E+00 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.53E-01 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Naphthalene

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	1.00E-04	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	2.54E+06	ug/l
Henry's Law Constant	H	=	2.00E-02	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>5.08E+04</b>	<b>mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	2.00E-02	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.20E+03	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	7.75E+01	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.08E+04 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	5.90E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.20E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>1.11E+00</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>5.48E-03 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>5.48E-03 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.86E-04 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>8.58E-04 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	8.58E-04 mg/kg-day
Reference dose	RfD	=	2.60E-03 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.86E-04 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Toluene

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.20E+04 mg/mole
Vapor pressure	VP	=	3.74E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	4.22E+06 ug/l
Henry's Law Constant	H	=	2.70E-01 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>1.14E+06 mg/m<sup>3</sup></b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	2.70E-01 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.40E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	9.04E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m <sup>3</sup> (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.14E+06 mg/m<sup>3</sup>**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.70E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.77E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>3.67E+01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Version: November 1999

## Risk Calculations

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.81E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>1.81E-01 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>9.45E-03 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>2.84E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	2.84E-02 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	9.45E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Trichlorofluoromethane (Freon 11)

Variable Descriptions	Units
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### CALCULATION OF SOIL GAS CONCENTRATION

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.40E+05 mg/mole
Vapor pressure	VP	=	1.05E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	6.63E+05 ug/l
Henry's Law Constant	H	=	4.00E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>2.65E+06 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	4.00E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.60E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.03E+01 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.65E+06 mg/m3**

### DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.70E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.77E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>8.54E+01 mg/m<sup>2</sup>-hour</b>

**SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL**

Page 2-2

**Risk Calculations**

Version: November 1999

**CALCULATING VAPOR CONCENTRATION IN BUILDING****A. INDOOR AIR COMPONENT**

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>4.22E-01 mg/m<sup>3</sup></b>

**B. OUTDOOR AIR COMPONENT**

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>4.22E-01 mg/m<sup>3</sup></b>

**EXPOSURE SCENARIO**

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.20E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>6.60E-02 mg/kg-day</b>

**NON-CARCINOGENIC RISK (Chronic Risk)**

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	6.60E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

**CARCINOGENIC RISK**

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.20E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Xylenes

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### **A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.10E+05	mg/mole
Vapor pressure	VP	=	1.05E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### **B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	1.10E+07	ug/l
Henry's Law Constant	H	=	3.00E-01	dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>3.30E+06</b>	<b>mg/m3</b>

#### **C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=		mg/kg
Henry's Law Constant	H	=	3.00E-01	dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00	gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	2.00E+02	cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	1.29E+01	cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00</b>	<b>mg/m3</b>

#### **D. SOURCE - Measured Soil Gas**

Measured soil gas concentration	C <sub>sg</sub> (m)	=		mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.30E+06 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01	dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.00E-02	cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.43E-03</b>	<b>cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01	m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>8.55E+01</b>	<b>mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>4.22E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 4.22E-01 \text{ mg/m}^3$$

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>2.20E-02 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>6.61E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	6.61E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.30E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	2.20E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** 1,2-Dichloroethane (EDC)

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.90E+04 mg/mole
Vapor pressure	VP	=	1.14E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	=	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	3.74E+04 ug/l
Henry's Law Constant	H	=	4.00E-02 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	=	<b>1.50E+03 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	4.00E-02 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	3.80E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	2.45E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	=	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.50E+03 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	1.00E-01 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>2.04E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>5.54E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

## Risk Calculations

Page 2-2

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>2.73E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>2.73E-04 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>1.43E-05 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>4.28E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	4.28E-05 mg/kg-day
Reference dose	RfD	=	2.70E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>1.59E-03</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	1.43E-05 mg/kg-day
Slope factor (potency)	SF	=	7.00E-02 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>9.99E-07</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Dichlorodifluoromethane

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.20E+05 mg/mole
Vapor pressure	VP	=	5.77E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(fp)</b>	<b>=</b>	<b>0.00E+00 mg/m3</b>

#### B. SOURCE - Groundwater

Water contamination level	C <sub>w</sub>	=	2.00E+05 ug/l
Henry's Law Constant	H	=	4.10E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(gw)</b>	<b>=</b>	<b>8.20E+05 mg/m3</b>

#### C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	4.10E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	5.80E+01 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	3.74E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg</sub>(s)</b>	<b>=</b>	<b>0.00E+00 mg/m3</b>

#### D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C <sub>sg</sub> (m)	=	mg/m3 (ug/l)
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**E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 8.20E+05 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	8.00E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	<b>=</b>	<b>1.63E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or C <sub>sg</sub>	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	<b>=</b>	<b>2.43E+01 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Version: November 1999

## Risk Calculations

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.20E-01 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>
<b>C. TOTAL INDOOR AIR CONCENTRATION</b>	<b>C<sub>t</sub></b>	=	<b>1.20E-01 mg/m<sup>3</sup></b>

### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>6.26E-03 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>1.88E-02 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	1.88E-02 mg/kg-day
Reference dose	RfD	=	5.70E-02 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>3.29E-01</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	6.26E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>No Slope Factor</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

## Risk Calculations

Version: November 1999

**Project Name:** BRC Former Boeing C-6 Facility, Los Angeles, California

**Chemical:** Carbon tetrachloride

Variable Descriptions	Units
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### **CALCULATION OF SOIL GAS CONCENTRATION**

#### **A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.50E+05 mg/mole
Vapor pressure	VP	=	1.51E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(fp)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### **B. SOURCE - Groundwater**

Water contamination level	C <sub>w</sub>	=	7.47E+02 ug/l
Henry's Law Constant	H	=	1.20E+00 dimensionless
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(gw)</sub></b>	=	<b>8.96E+02 mg/m3</b>

#### **C. SOURCE - Soil < 100 mg/kg**

Soil contamination level	C <sub>t</sub>	=	mg/kg
Henry's Law Constant	H	=	1.20E+00 dimensionless
Bulk density (dry)	ρ <sub>b</sub>	=	1.47E+00 gm/cc
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Water-filled porosity	θ <sub>w</sub>	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f <sub>oc</sub>	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K <sub>oc</sub>	=	1.50E+02 cm <sup>3</sup> /gm
Soil/water distribution coef.	K <sub>d</sub>	=	9.68E+00 cm <sup>3</sup> /gm
<b>Calculated soil gas concentration</b>	<b>C<sub>sg(s)</sub></b>	=	<b>0.00E+00 mg/m3</b>

#### **D. SOURCE - Measured Soil Gas**

Measured soil gas concentration	C <sub>sg(m)</sub>	=	mg/m3 (ug/l)
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#### **E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 8.96E+02 mg/m3**

### **DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ <sub>a</sub>	=	1.92E-01 dimensionless
Diffusion coefficient in air	D <sub>a</sub>	=	7.80E-02 cm <sup>2</sup> /sec
<b>Effective diffusion coefficient</b>	<b>D<sub>e</sub></b>	=	<b>1.59E-03 cm<sup>2</sup>/sec</b>
Depth of contamination or Csg	X	=	1.98E+01 m
<b>Calculated Flux</b>	<b>F<sub>x</sub></b>	=	<b>2.59E-02 mg/m<sup>2</sup>-hour</b>

# SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

## Risk Calculations

Version: November 1999

### CALCULATING VAPOR CONCENTRATION IN BUILDING

#### A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m <sup>2</sup>
% of floor area that flux occurs			1.00E+00 dimensionless
Attenuation factor(Crack factor)	S <sub>b</sub>	=	1.00E-02 dimensionless
Flux area within building	A <sub>f</sub>	=	1.00E-02 m <sup>2</sup>
Interior Height of building	R <sub>h</sub>	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m <sup>3</sup>
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m <sup>3</sup> /hr
<b>Indoor air component</b>	<b>C<sub>i</sub></b>	=	<b>1.28E-04 mg/m<sup>3</sup></b>

#### B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
<b>Outdoor air component</b>	<b>C<sub>o</sub></b>	=	<b>0.00E+00 mg/m<sup>3</sup></b>

#### C. TOTAL INDOOR AIR CONCENTRATION

	C <sub>t</sub>	=	1.28E-04 mg/m <sup>3</sup>
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### EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m <sup>3</sup> /hr
Inhalation rate	IR	=	4.80E+01 m <sup>3</sup> /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
<b>Chemical Intake (carc. risk)</b>	<b>IT<sub>c</sub></b>	=	<b>6.67E-06 mg/kg-day</b>
<b>Chemical Intake (non-carc. risk)</b>	<b>IT<sub>nc</sub></b>	=	<b>2.00E-05 mg/kg-day</b>

### NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT <sub>nc</sub>	=	2.00E-05 mg/kg-day
Reference dose	RfD	=	6.86E-04 mg/kg-day
<b>Hazard Index</b>	<b>HI</b>	=	<b>2.92E-02</b>

### CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT <sub>c</sub>	=	6.67E-06 mg/kg-day
Slope factor (potency)	SF	=	1.50E-01 1/(mg/kg-day)
<b>Cancer Risk</b>	<b>Risk</b>	=	<b>1.00E-06</b>

## GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	$f_{oc}$ (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
I-34-20	1/22/2001	20	Silt	1.51	24.1	0.45	0.10	0.36	500	0.05
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-004 (I-34-20)	1/29/2001	20	Silt	1.54	17.5	0.42	0.15	0.27	330	0.03
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	1.35	4.4	0.51	0.45	0.06	230	0.02
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA290176-012 (D-29-20)	1/29/2001	20	Silt	1.55	17.0	0.41	0.15	0.26	430	0.04
EIA290176-015 (D-29-50)	1/29/2001	50	Fine sand	1.36	19.5	0.49	0.22	0.26	560	0.06
EIA290176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
EIA290176-021 (I-25-20)	1/29/2001	20	Silt	1.37	20.2	0.48	0.20	0.28	410	0.04
EIA290176-024 (I-25-50)	1/29/2001	50	Silt	1.34	24.3	0.51	0.18	0.32	470	0.05

**Average**

1.47	0.45	0.19	0.26	645	0.06
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Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

\*  $f_{oc}$  = the weight fraction of organic carbon in soil = TOC/10,000

## CHEMICAL PARAMETERS

CAS No.	More prevalent and higher concentration volatile organic chemicals (VOCs)	MW (mg/mole)	H' (dimension-less)	Da (cm <sup>2</sup> /sec)	VP (atm)	Temp. (°C)	K <sub>oc</sub> (cm <sup>3</sup> /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg·day) <sup>-1</sup>	Chronic RfD (inh) (mg/kg·day)
79-01-6	Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	b	9.4E+01	a	1.1E+03
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	b	2.4E-02	a	2.0E+02
75-09-2	Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	a	5.7E-01	b	1.3E-04
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	a	7.8E-02	a	1.6E-01	b	1.3E-03
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	a	7.8E-01	b	2.3E+03
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	a	7.4E-02	a	2.4E-04	a	3.5E+03
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	a	7.1E-02	a	5.2E-01	b	3.6E+03
75-01-4	Vinyl Chloride	6.3E+04	a	1.1E+00	a	1.1E-01	a	3.5E+00	b	1.9E+01
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	a	7.4E-02	a	3.1E-01	b	2.80E+03
79-00-5	1,1,2 - TCA	1.3E+05	a	3.7E-02	a	7.8E-02	a	3.1E-02	b	5.3E+01
71-43-2	Benzene	7.8E+04	a	2.3E-01	a	8.8E-02	a	1.2E-01	b	6.2E+01
67-66-3	Chloroform	1.2E+05	a	1.5E-01	a	1.0E-01	a	2.6E-01	b	5.3E+01
100-41-4	Ethylbenzene	1.1E+05	a	3.2E-01	a	7.5E-02	a	1.3E-02	b	2.0E+02
78-93-3	Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	a	9.0E-02	a	1.2E-01	b	2.0E+02
1634-04-4	MTBE	8.5E+04	a	2.4E-02	a	8.0E-02	a	3.3E-01	b	4.5E+00
91-20-3	Naphthalene	1.3E+05	a	2.0E-02	a	5.9E-02	a	1.0E-04	b	1.2E+03
108-88-3	Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	a	3.7E-02	b	7.9E+03
75-69-4	Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	a	8.7E-02	a	1.0E+00	b	1.7E+02
1330-07-7	Xylenes	1.1E+05	a	3.0E-01	a	7.0E-02	a	1.1E-02	b	2.0E+02
107-06-2	1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	a	1.0E-01	a	1.1E-01	b	3.8E+01
75-71-8	Dichlorodifluoromethane	1.2E+05	a	4.1E+00	a	8.0E-02	a	5.8E+00	b	2.8E+02
56-23-5	Carbon tetrachloride	1.5E+05	a	1.2E+00	a	7.8E-02	a	1.5E-01	b	1.5E+02

## References:

- a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
- b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.ncbi.nlm.nih.gov/pubs/factsheets/hsdbfs.html>
- c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
- d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, [http://risk.lsd.ornl.gov/cgi-bin/tox/TOX\\_select?select=csf](http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf)
- e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/arb2588/riskassess.htm>
- Toxicity Value reference priority:
1. Cal-EPA, Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
  2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/arb2588/riskassess.htm>
  3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.